

whereas the front of the male *albiceps* is wider, the eyes being separated by a distinct interval; there are also other minor characters, such as the dorsum of the thorax of *putoria* being partly greyish pollinose, while that of *albiceps* is shining and not pollinose. Using these characters, I have examined a long series of both species from various localities, and in particular a small collection of *albiceps* taken by Major Austen from the Mount of Olives, Palestine: also many hundreds of specimens from India and Australia. The Palestine form differs from the Indian in the following respects:—The face in the Palestine females is much more silvery white, whereas it is of a dirty yellow colour in the Indian specimens; the antennae of the Palestine species are not nearly so red as those of the Indian forms; the palpi are darker orange, whereas those of the Indian ones are lighter orange; the abdominal bands are narrower than in the specimens from India.

Most of the specimens collected on the White Nile and in Sierra Leone agree with the Indian form; the African males, like the Indian, have a narrower front than those of the Palestine specimens. But on examining a series of specimens labelled *albiceps* in the National Collection, I note that there are males with fronts intermediate between the Palestine males on the one hand, and the African ones on the other, and that in some the abdominal bands are broad, broader than the Palestine specimens. This collection also contains three specimens labelled *albiceps* var. *bibula*, Wiedemann, by Dr. Villeneuve from British East Africa and North West Rhodesia, and I can see no difference between these and the Indian forms named by that authority as *putoria*. Therefore without going any further into the identity of Wiedemann's two species, it is quite clear that there are two distinct forms which merge into each other, and for this reason I prefer in the meantime to place both under the name *albiceps*, including Wiedemann's variety *bibula*. As soon as I have completed my studies of the external genitalia of both sexes of these forms, I shall be in a position to express a final opinion as to whether they are to be considered distinct species or mere racial forms.

Major Austen kindly showed me some larvae which he collected among some weeds when searching for *Anopheles* larvae in Palestine, and on examining them macroscopically, I could see no difference between them and the larvae of the species from India. Both have the same type of fleshy processes with a tuft of spines at their apices, and short of examining them microscopically I consider they are identical. I am of course assuming that they are the larvae of *albiceps*, though there is no proof of this, as the flies were not bred from them. I trust those who have opportunities of collecting larvae of either form, but especially *albiceps*, will send me larvae for microscopic study.

There is an interesting specimen in the National Collection of what conforms to the *putoria* type, from Lourenço Marques, bred from a larva from an infected human sore. I have compared this specimen with the Indian and Palestine species, and find that the face is as white as that of the Palestine females, and the abdominal bands are broader. It is evident then that this form may cause human myiasis in man. I have no record of this hairy larva from human or animal tissues in India, though, of course, *Chrysomya rufifacies* commonly attacks sheep in Australia.

Lucilia rufacies is recorded by Macquart as a species described by Guérin, but so far I have failed to find Guérin-Ménéville's description of this species and do not know where it was published; Macquart says the species is from Australia. I have examined a large number of specimens of this species from the Australian region in the National Collection as well as in my own, and note that many of the males have fronts as narrow as the form *putoria*, others have fronts as wide as those of the males of the Palestine *albiceps* form noted above, so that here again we have a variable species, and it is very evident that it will be necessary to make a much more exhaustive study of all three forms to find the limits of variation as well as the characters of the external genitalia. I shall be glad to have a large number of specimens from the Australian region in order to complete this work.

I believe Robineau-Desvoidy's *Lucilia bengalensis*, from Bengal, and his *Ch. dejeanii*, from Africa, are synonyms of *albiceps*.

4. ***Chrysomya villeneuvei*, Patton.**

I described this interesting and striking species in a recent number of the Indian Journal of Medical Research, pointing out that its larvae have long fleshy processes with spines on their shafts as well as their apices. It breeds in dead bodies of mammals and birds, its larvae feeding on the juices of the larvae of other necrophagous Dipterous larvae, as do the larvae of *albiceps*, but I can find no description of this species in the literature, nor are there any specimens in the National Collection. I have no doubt that it has not been recorded previously to my description. So far I have seen it only in South India, and it is essentially a wild species, never being seen to my knowledge in bazaars as would be expected.

5. ***Chrysomya combrea*, Walker.**

Synonyms: *Chrysomyia (Musca) defixa*, Walker.
Chrysomyia (Musca) pinguis, Walker.
Chrysomyia nigriceps, Patton.

At the time of describing this common species of *Chrysomyia*, I was unable to get it determined, so named it *nigriceps*. But having examined Walker's types of *combrea*, *defixa* and *pinguis*, I am able to say that it is identical with these three species. It does not appear to have been described previously to Walker's *combrea*. It is mainly a temperate species and is found in all the hill stations of South India, as well as in the North, and Mr. Senior-White collected specimens in Shillong. It breeds in the dead bodies of birds and small mammals. The male has a large-lensed area on the eyes as in the male of *Chrysomyia megacephala*. I have not seen any specimens from outside the Indian area.

I have at least one other species of *Chrysomyia* from this region which I have not been able to determine, and for which I can find no description in the works of the older writers. I shall describe it on another occasion.

6. ***Chrysomya marginalis*, Wiedemann.**

Synonyms: *Chrysomyia regalis*, Robineau-Desvoidy.
Chrysomyia (Cosmina) arabica, Robineau-Desvoidy.
Chrysomyia (Somomyia) marginalis, Bertolini.
Chrysomyia (Paracompsomyia) nigripennis, Hough.

This widely distributed African species has been recorded by Major Austen from Quetta. I have so far not seen any specimens from India other than the one from Quetta.

7. ***Lucilia argyricephala*, Macquart.**

Synonyms: *Lucilia (Musca) temperata*, Walker.
Lucilia (Musca) serenissima, Walker.
? *Lucilia (Musca) fuscina*, Walker.
Lucilia indica, Robineau-Desvoidy.

This widely distributed and important species was first described from the Cape. It is a well-known myiasis-producing species in Africa, its larvae having been recorded from human as well as animal tissues. In India I have had its larvae from animals, but not, so far, from man. It normally breeds in decaying animal matter and is a common fly in the bazaars of India, Burma and Ceylon.

I have examined Walker's types of *temperata*, *serenissima* and *fuscina*, and consider that they are all synonyms of *argyricephala*.

8. *Lucilia inducta*, Walker.

Synonym : *Lucilia craggii*, Patton.

This is another common Indian species, which I recently described under the name *craggii*. It is, like *Chrysomya combrea*, mainly a hill species and is common in the north of India, and Mr. Senior-White has collected it in Shillong. It is a large blue species, and behaves much in the same way as does *Calliphora erythrocephala* in this country, coming into houses and buzzing round food. It breeds in the dead bodies of birds and small mammals.

9. *Lucilia pulchra*, Wiedemann.

Synonym : *Lucilia (Musca) phellia*, Walker.

This handsome species, one of the most beautifully coloured of all the CALLIPHORINAE known to me, is widely distributed in India. It is a larviparous species and never settles on food in the bazaars, but is for the most part found on flowers, and the female on decaying animal matter and dung of all kinds. Walker's type of his *Musca phellia*, a female, is this species. I have given a full description of it, as well as its larva and puparium, in a recent number of the Indian Journal of Medical Research.

10. *Lucilia metilia*, Walker.

Synonym : ?*Lucilia ballardii*, Patton.

The type of Walker's *Musca metilia*, from Nepal, is a male *Lucilia* in very bad preservation. I have come to the conclusion provisionally that it is the same as the species recently described by me as *Lucilia ballardii* from South India.

11. *Lucilia sericata*, Meigen.

There are two specimens, a male and female, of this well-known European semi-specic myiasis-producing fly from Parachinar, Kurram Valley, North West Frontier Province, India, in the National Collection, bred from larvae collected by Sinton from a case of human cutaneous myiasis. This is the first record of this species from the Indian Region, and I have not seen it from any other part of India.

12. *Calliphora aucta*, Walker.

This is the common Indian species of this genus, and has, I have little doubt, been mistaken for *C. erythrocephala*. It is common in the hill stations in North India, and I have recently received a number of specimens from Kashmir, collected by Dr. Baini Prashad, of the Zoological Survey of India.

This concludes my notes on the Oriental species that I have been able to study, and I need hardly say I shall be very glad to receive any specimens of CALLIPHORINAE from any part of the world, and any larvae with flies bred from them would be most valuable. I hope soon to start a series of comparative studies of some of the commoner species, describing their early stages in detail.

I have not attempted to unravel the difficult synonymy of the species of *Pyrellia* and *Pseudopyrellia*. The names of the species belonging to these genera are at present in hopeless confusion. But as soon as I have an opportunity of examining Bigot's types, as well as those of Walker, it may be possible to determine the known species accurately.

As soon as I have sufficient material from the Australian region, I hope to deal with the species of CALLIPHORINAE from that area in Part II of these notes.

A REMARKABLE MOSQUITO, *OPIFEX FUSCUS*, HUTTON.

By DAVID MILLER, F.E.S.,

New Zealand Government Entomologist.

When carrying out an investigation into the mosquitos of New Zealand,* the writer found that a very common species bred in saline and semi-saline pools above high water mark along the rocky parts of the North Island coast line. For some time it was considered that this mosquito was unrecorded, but it appears that Hutton described it as a Tipulid under the name *Opifex fuscus*.† This was pointed out to me both by Mr. G. V. Hudson, of Wellington, who is in possession of Hutton's Tipulid types and had seen the illustrations here reproduced, and later on by Mr. F. W. Edwards, of the British Museum, who published a short account of the insect from material recently sent to him by Mr. Hudson.‡

So remarkable are the adult and pre-adult characters of this mosquito, that the writer considers there are sufficient grounds for the erection of a new sub-family for its reception. The following is an account of the adult and pre-adult stages with a revised outline of the generic characters.

Subfamily OPIFICINAE, nov.

Scales of the head and scutellum flat ; male antennae not plumose ; male palpi not quite as long as the proboscis, those of the female short ; proboscis slightly recurved ; scutellum trilobed ; cell R_2 of wing slightly longer than cell M_2 .

This subfamily is apparently near the MEGARHININAE of Theobald, which it resembles in the flat scales of the head and scutellum ; the slightly recurved proboscis also approaches the strongly recurved form characteristic of that subfamily, to one genus of which also (*Toxorhynchites*) the short palpi of the female bear some resemblance. The relative lengths of cells R_2 and M_2 , however, together with the character of the male antennae exclude this species from the MEGARHININAE.

Genus *Opifex*, Hutton.

Antennae of male not plumose, the third, fourth and fifth joints each with a distinct dorsal spine arising from a pronounced basal swelling. Palpi of male clubbed at the apex, about two-thirds the length of the proboscis, which is slightly curved backwards ; neither proboscis nor palpi conspicuously haired. Antennae of female without the three spines present in the male ; palpi very short. Clypeus globular. Occiput clothed with flat scales. Legs of female normal, the front pair of the male short and stout, their claws simple but very long. Scutellum trilobed, clothed with flat scales and long bristles ; metanotum bare. Wings with base of cell R_2 somewhat anterior to that of cell M_2 , the former a little longer than the latter ; cross-vein r-m anterior to origin of vein R_{4+5} ; cross-vein m-cu a little more than its own length posterior to cross-vein r-m.

Opifex fuscus, Hutton.

♂. General colour blackish. Occiput cinereous, with a pronounced median fissure extending from the vertex to a prominence above the foramen ; uniformly clothed, except in the fissure, with white flat scales (fig. 1, a) ; bristles of posterior

* Miller, D., "Report on the Mosquito Investigation," pt. 1, N. Z. Dept. of Health Bull., no. 3 (1920).

† Hutton, F. W., Trans. N. Z. Inst., xxxiv, p. 188 (1902).

‡ Edwards, F. W., Bull. Ent. Res., xii, p. 73 (1921).

orbits large and black ; eyes blue-black. Antennae (fig. 1) black, with a vestiture of minute greyish hairs ; not plumose, 14-jointed, the joints for the most part narrow and not swollen ; second joint bristly ; third, fourth and fifth with a dorsal row of

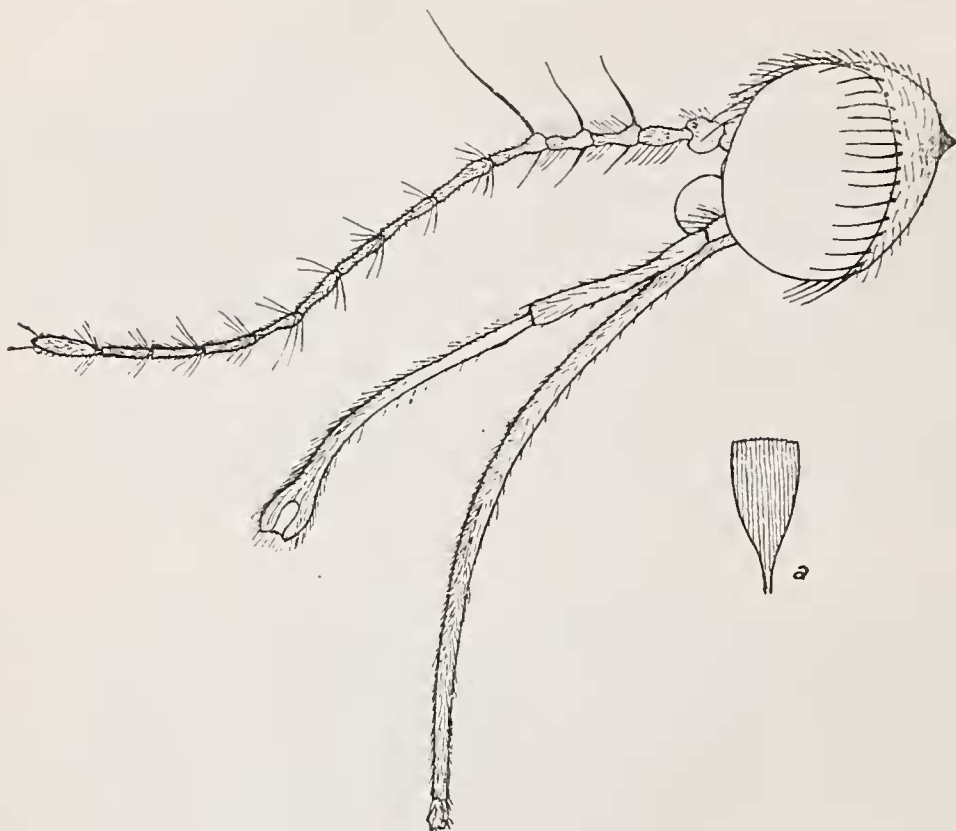


Fig. 1. Head of *Opifex fuscus*, Hutton, ♂ ; *a*, an occipital scale, enlarged.

bristle-like hairs and a basal and apical whorl of bristles, the apical ones more delicate and hair-like ; each of these three joints with a prominent dorsal swelling basally, from each of which arises a strong elongate spine, that of the fifth joint being nearly

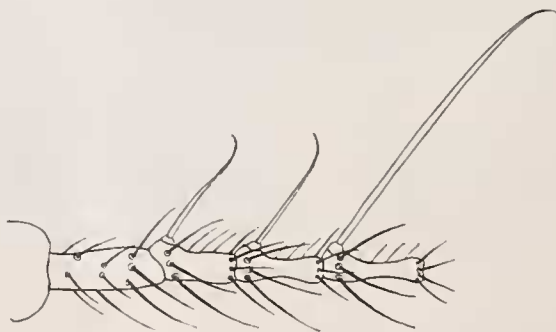


Fig. 2. Basal antennal joints of ♂.

three times as long as either of the other two (fig. 2) ; each spine appears to arise from a swelling giving the appearance of a short joint ; joints 6-14 with a basal whorl of bristle-like hairs ; apical joint elongate-oval terminating in two short hairs.

Palpi black, about two-thirds the length of the proboscis (fig. 1), clubbed at the apex, 3-jointed, with a vestiture of short, delicate greyish hairs ; first joint short and distinctly bristly ; second elongate, but not half the length of the whole ; third joint

elongated, swollen at the apex, about half the length of the whole, the apex truncated and with some bristle-like hairs and a cup-shaped depression apparently leading into an elongate glandular sac. Surface of the third joint, except for the apical knob, transversely striated by trachea-like ridges giving a serrated appearance in outline ; under a high power the ridges are seen to carry minute bristles and are not continuous but broken ; on the second joint the ridges are diagonally arranged distally, but disappear proximally, where the minute bristles are irregularly arranged ; there are no ridges on the basal joint.

Proboscis longer than the palpi (fig. 1), curved slightly backward in nearly all specimens ; black in colour and clothed with white flat scales and short greyish hairs. Labrum-epipharynx (fig. 3, 3 *a*) strongly developed. Clypeus globular, black in colour but with greyish reflections.



Fig. 3. Labrum-hypopharynx of ♂; *a*, apex of hypopharynx.

Thorax and scutellum black with cinereous reflections ; dorsum sparsely clothed with golden and black spindle-shaped scales and rows of black bristles ; scutellum trilobed, clothed with white flat scales and strong black bristles from each lobe ; pleurae cinereous, clothed with white flat scales ; ptero-pleurae with a tuft of golden hair-like bristles above and larger black bristles below ; mesopleurae with black bristles below ; metanotum nude, blackish brown with cinereous reflections.



Fig. 4. Wing of *Opifex fuscus*.

Wings (fig. 4) translucent, without markings, apex blunt ; base of cell R_2 somewhat anterior to that of cell M_2 , the former a little longer than the latter, which however is distinctly wider ; cross-vein $r-m$ anterior to origin of vein R_{4+5} , which is geniculated ; cross-vein $m-cu$ a little more than its own length posterior to cross-vein $r-m$; veins purple to blackish brown ; the scales long and linear, among which are shorter and rather broader ones. Halteres with black globular heads and white flat scales, the stalks yellow to golden.

Anterior legs (fig. 5) stout and very much shorter than the others ; brownish black, clothed with short closely-set black bristles and flat greyish scales, becoming white on proximal part of the femora, which have a proximal row of three black bristles on upper lateral surface ; the tibiae shorter than the femora and distinctly widened ; tarsal joints swollen apically, the pro-tarsus about half the length of the whole, the following joints shortening consecutively, the onychotarsus being very short ; claws

simple, extremely long, being about one-third the length of the tarsus. Middle and posterior legs slender, the former the longer; both deep purplish-blue with a lighter brown reflection and clothed with white scales and distinct scattered bristles;



Fig. 5. Anterior leg of ♂.

a row of widely separated bristles distally on anterior side of the femora; the tibiae—the posterior pair being slightly swollen apically—with a row of bristles on the posterior side and another more dorsally; tarsi with a dorsal row of bristles; claws simple and normal. All the femora and tibiae white at the apex.

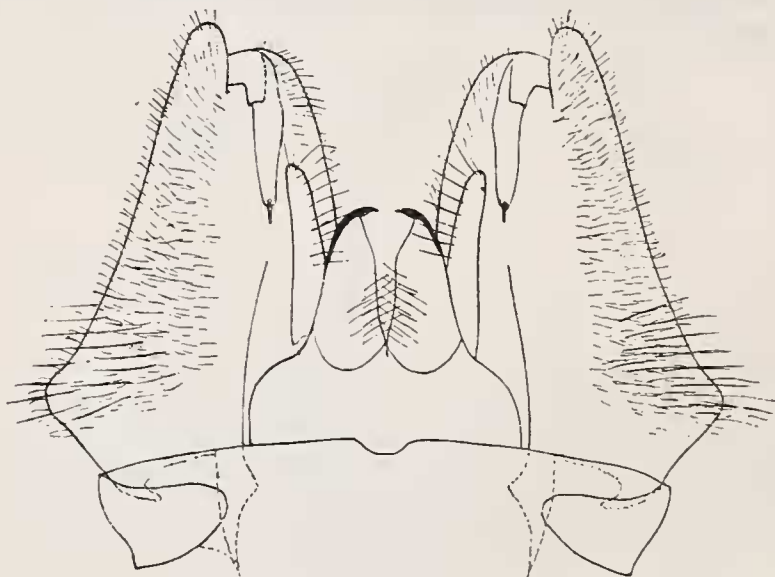


Fig. 6. Male genitalia of *Opifex fuscus*.

Abdomen shiny brownish black, clothed with short black bristles and white flat scales, the latter arranged as triangular spots at the anterior angles of each segment. Genitalia prominent, their structure shown in fig. 6.



Fig. 7. Palpus of ♀.

♀. Palpi (fig. 7) about one-fourth the length of the proboscis, 4-jointed, with a stricture near apex of fourth joint; swollen apically, black, clothed with white scales and black bristles. The maxillae (figs. 8, 9) strongly serrated at the tip, the "feathery corrugations" referred to by Dimock being readily seen on the transparent "shaft of the maxilla." In *O. fuscus*, however, the "chitin-rod" apparently



Fig. 8. Maxilla of ♀.

lies along the centre of the shaft, the two sides of which lie in a **V**-shaped position, forming a partial tube with the rod running along the fork of the fold. Antennae

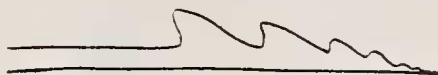


Fig. 9. Apex of maxilla of ♀.

14-jointed, with no spines as in the ♂ but each joint with a whorl of sparsely set, bristle-like hairs longer on proximal joints. Front legs and claws normal. Colour as in the ♂, but the scales golden at times, and the body a deep purplish-blue in some

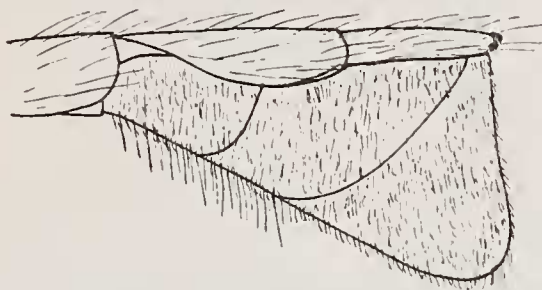


Fig. 10. Apex of abdomen of ♀ as it appears in a dried specimen.

lights. Apical sternites of abdomen swollen and descending in dried specimens (fig. 10), but normal and evenly rounded with the rest of the abdominal sternites in the living insect.

Length of ♂ and ♀, 5 mm.

Larva.

Larva blackish brown or sometimes greenish in colour, the segments well defined. Siphon short, twice as long as broad, with a pair of branched hair-tufts ventrally a little above the middle (fig. 11) ; siphonal pecten consisting of three short bristles

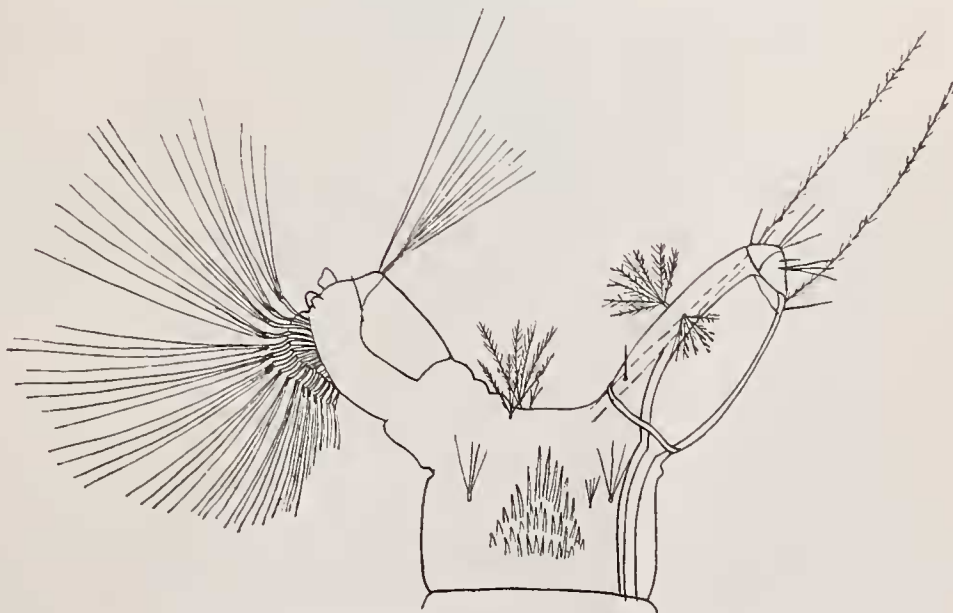


Fig. 11. Siphon and apical abdominal segments of larva of *Opifex fuscus*.

(fig. 12), on the opposite side to which, near the base of the siphon, is a single spine (fig. 11). Orifice of siphon closed externally by a pair of cup-shaped valves, from each of which arises a tuft and a single hair ; on the siphon near the orifice is a bristle-like hair and two very long and delicate branched ones ; internally the two tracheae

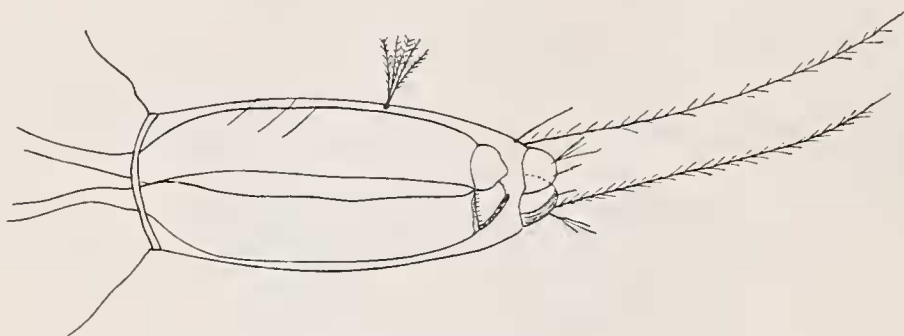


Fig. 12. Siphon of larva.

do not reach the external valves, each tracheal opening being protected by a cup-shaped valve, one being opposed to the other, so that when drawn together their rims meet and completely close the tracheae (fig. 12). Along the lower inner edge of each valve where attached to the trachea is a ridge bearing numerous short and delicate hairs (fig. 13).

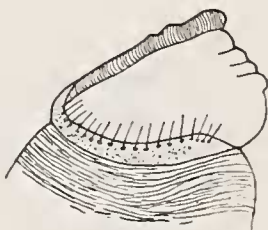


Fig. 13. An internal tracheal valve of larva.

Anal plate confined to the distal two-thirds of the anal segment and extending on each side to the median line (fig. 11) ; an inconspicuous bristle arises from anal plate on one side. Hair-tufts on dorsal angle of anal segment consisting of a pair of long straight hairs and a single tuft of somewhat shorter ones. Anal gills absent and represented by three short tubercles capable of being retracted (fig. 11). Ventral fringe well developed, consisting of several tufts of very long hairs.

Comb of eighth segment triangular, the spines strong and stout, those at the apex large and conspicuous but very short at the base ; the vestiture of this segment as in accompanying diagram (fig. 11).

Head pendulous, transversely ovate from above, narrower than the thorax, opaque ; mouth-brushes golden. Antennae apparently single-jointed, bare, except for the short terminal hairs (fig. 14). Clypeus slightly sinuated and armed with a pair of straight spines. Labrum cuneiform, its apex extending beyond the chitinous processes of the mouth-brushes ; its surface clothed with bristle-like hairs, while near its base in front of the clypeus is a small hair-tuft ; at the apex dorsally is a

clavate yellow structure clothed with hairs and with a darker central spot at its apex (fig. 14). Vestiture also shown in figure.



Fig. 14. Head of larva, dorsal aspect.

Mandibles (fig. 15) roughly rectangular, the articular surface broad, the sides converging and triangular in transverse median section: a single elongate spine on angle of outer ridge; a large claw-like and toothed appendage attached near the



Fig. 15. Mandible of larva.

outer molar angle, and from the base of the claw arise several bristle-like hairs; this appendage is apparently freely movable; on the outer molar angle is also a short toothed* appendage, while at the inner angle is a bifid hairy projection. Along one

* These appendages, in variable form, are present on the mandibles of other New Zealand mosquito larvae. They resemble to a great extent the appendages on the mandible of *Campodea* as figured by Packard in his Text-book of Entomology, p. 60, fig. 48; the movable claw resembling his prostheca, or lacinia, and the others his galea. In some other species there is a pair of elongate spines on the angle of the outer ridge agreeing with the observations of other authors.

side of the outer edge is a row of minute and strongly recurved spines, while opposite and parallel to these is a row of delicate hairs, each inserted in a small tubercle. Extending from the spine on the upper angle on to the side of the mandible is a broad ridge bearing numerous long hairs. The lower side consists of two ridges, upon each of which is a condyle for the attachment of the mandible to the cranium.

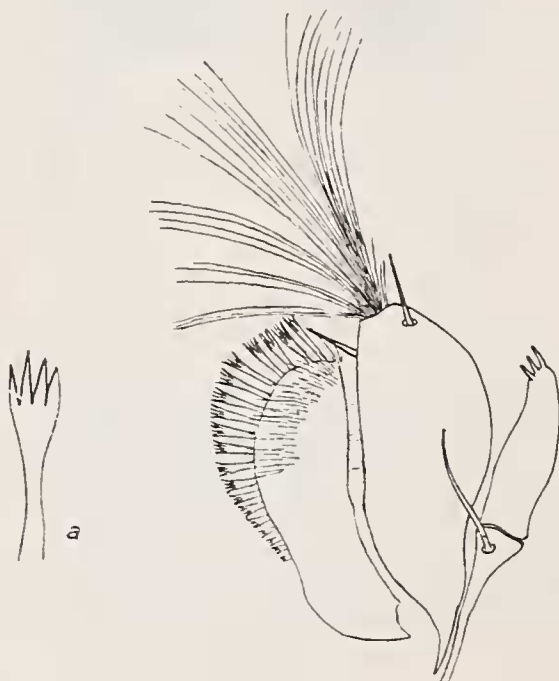


Fig. 16. Maxilla of larva, dorsal aspect ;
a, forked hair.

Maxillae (fig. 16) brownish, each, as a whole, roughly ovate but separated into two parts, apparently representing the galea and lacinia, by a median fissure extending from the apex to the base, while on the outside of the galea is a well-developed two-jointed palpus. The lacinia is shorter than the galea, and along its outer margin and upon the anterior part of the dorsal surface are numerous flat forked bristles (fig. 16, 16 a), which become short posteriorly and do not extend to the articulation ; ventrally from the apex and almost to the articulation runs a ridge from which arise numerous long golden hairs directed outwards. The galea is shaped like the lacinia, but is truncated apically to carry a dense plume of golden brown hairs, which are as long as the whole maxilla ; on each side just below the apex is a stout spine, the dorsal one arising near the outer margin and the ventral near the inner (fig. 16). Ventrally runs an indistinct ridge, near the inner margin, extending from the apex to the articulation and between this ridge and the inner margin arise innumerable golden hairs ; towards the apex the surface is clothed with long delicate hairs. The palpus is two-jointed, the terminal joint being elongate and evenly rounded, though somewhat narrower apically and terminated by three short blunt teeth ; the basal joint is clavate and elongate, tapering to the articulation, while dorsally near its anterior margin arises a long sinuated spine (fig. 16). Ventrally towards the base of the apical joint are numerous delicate hairs. At the articulation the lacinia is produced to a point and the galea evenly rounded. The galea, lacinia and palpus of each maxilla are united by a basal membrane, a continuation of which also attaches